"When everybody keeps score, you’re afraid you’re gonna lose. Just ignore ’cuz they don’t know the real you.”

**Problem 1.** Circle True or False. (1pt each)

a. (True or False) For any \( x \in (-\infty, \infty) \), \( \sin^{-1}(\sin(x)) = x \).

**Solution:** False. Note that \( \sin^{-1}(\sin(2\pi)) = \sin^{-1}(0) = 0 \)

b. (True or False) For any \( x \in (-\infty, \infty) \), \( \tan(\tan^{-1}(x)) = x \).

**Solution:** True.

**Problem 2.** Find the range and zeros of \( e^{2x} - 4e^x + 3 \) (4pts)

**Solution:** Let \( u = e^x \), then our expression becomes \( u^2 - 4u + 3 = (u - 2)^2 - 1 \). Therefore, the zeros are \( u = 1, 3 \Rightarrow x = 0, \ln(3) \). Since \( u = 2 \) gives the minimum of this quadratic, the range is \([-1, \infty)\).
Problem 3. Find $\sin(2 \tan^{-1}(x))$ (4pts)

Solution: Let $\theta = \tan^{-1}(x)$. Then, the triangle with angle $\theta$ has opposite to adjacent ratio of $x$, so let the opposite side have length $x$ and adjacent side have length 1. Then, note that $\sin \theta = \frac{x}{\sqrt{x^2+1}}$, $\cos \theta = \frac{1}{\sqrt{x^2+1}}$.

Therefore, $\sin(2\theta) = 2 \sin \theta \cos \theta = \frac{2x}{x^2+1}$. 